

WHAT IS CLAIMED IS:

1. A method for operating the spacecraft-related portion of an arrangement for transmitting Available Bit Rate service Asynchronous Transfer Mode (ATM) data over a transmission path including a spacecraft, where the spacecraft includes transmission path ATM data routing switches which lack capability for marking Resource Management cells with congestion information, said transmission being in an Available-Bit-Rate operating mode in which data is transmitted over the transmission path in bandwidth which is otherwise unused by services other than Available Bit Rate service Asynchronous Transfer Mode data, said method comprising the steps of:

at a source terminal which transmits said Available Bit Rate service Asynchronous Transfer Mode data to said spacecraft, receiving from a source node Available Bit Rate service Asynchronous Transfer Mode data including Resource Management cells, and deleting the Resource Management cells from the stream of Available Bit Rate Asynchronous Transfer Mode data flowing to the spacecraft, so as to reduce the amount of superfluous data flowing in an ABR bandwidth portion of the spacecraft resources;

determining at least the presence of absence of congestion in the spacecraft payload in paths associated with said Available Bit Rate service Asynchronous Transfer Mode data by means other than by use of said routing

switches, to thereby produce spacecraft-  
congestion-related signals;

35           coupling said spacecraft-congestion-  
related signals by way of at least a downlink  
to said source terminal; and

          at said source terminal, using  
information derived from said spacecraft-  
40   congestion-related signals to mark back  
Resource Management cells for return to said  
source.

2.   An arrangement for transmitting  
Available Bit Rate service Asynchronous  
Transfer Mode (ATM) data over a transmission  
path including a spacecraft, said Available-  
5   Bit-Rate operating mode being one in which data  
is transmitted over the transmission path in  
bandwidth otherwise unused by services other  
than said Available Bit Rate service  
Asynchronous Transfer Mode data, said  
10   arrangement comprising:

          a source of Available Bit Rate  
service Asynchronous Transfer Mode data which  
generates Resource Management cells and  
combines said Resource Management cells with  
15   information data to form said Available Bit  
Rate service Asynchronous Transfer Mode data to  
be transmitted, and which is responsive to  
congestion-indicative information contained  
within returned Resource Management cells for  
20   adjusting the transmission rate of at least  
said Asynchronous Transfer Mode data portion of  
said Available Bit Rate service Asynchronous

Transfer Mode data to tend to maintain in use,  
for said Asynchronous Transfer Mode data, said  
25 bandwidth otherwise unused, while tending to  
avoid congestion which might otherwise result  
in loss of Asynchronous Transfer Mode data  
cells;

30 a spacecraft including transmission  
data path switches which do not mark Resource  
Management cells with congestion information,  
and a terrestrial Network Control Center  
communicating with said spacecraft, said  
Network Control Center co-acting with said  
35 spacecraft to determine the level of congestion  
in at least one service other than said  
Available-Bit-Rate service Asynchronous  
Transfer Mode data, and to tend to control said  
congestion in said at least one service other  
40 than said Available Bit Rate service  
Asynchronous Transfer Mode data by means of  
payload congestion control signals transmitted  
between said spacecraft and said Network  
Control Center over a signal path including an  
45 uplink and a downlink;

a terrestrial spacecraft source  
terminal coupled to receive Available Bit Rate  
service Asynchronous Transfer Mode data from  
said source of Available Bit Rate service  
50 Asynchronous Transfer Mode data, and  
communicating, by means of uplinks and  
downlinks, with said spacecraft, said  
spacecraft source terminal being arranged for  
receiving Resource Management cells associated  
55 with said Available Bit Rate service

Asynchronous Transfer Mode data, and for marking said Resource Management cells in locations indicative of at least the presence or absence of congestion, and of returning said  
60 Resource Management cells, so marked, toward said source of Available Bit Rate service Asynchronous Transfer Mode data, in the form of back Resource Management cells, and also being arranged for transmitting at least said  
65 Asynchronous Transfer Mode data portion of said Available Bit Rate service Asynchronous Transfer Mode data to said spacecraft over an uplink;

means located at said terrestrial  
70 spacecraft source terminal for receiving said payload congestion control signals, and for marking said Resource Management cells with payload congestion information derived from said payload congestion control signals  
75 originating from said Network Control Center, thereby closing a control loop including said source of Available Bit Rate service Asynchronous Transfer Mode data, said terrestrial spacecraft source terminal, and  
80 said spacecraft, whereby congestion of said Available Bit Rate service Asynchronous Transfer Mode data tends to be controlled in that portion of said transmission path including said source of Available Bit Rate  
85 service Asynchronous Transfer Mode data, said terrestrial spacecraft source terminal, and said spacecraft.

3. An arrangement according to claim 2, further comprising:

means at said terrestrial spacecraft source terminal for deleting at least some of  
5 said Resource Management cells from said Asynchronous Transfer Mode data which is transmitted over said uplink to said spacecraft; and

a terrestrial destination terminal  
10 coupled to said spacecraft by uplinks and downlinks, said terrestrial destination terminal including means for adding forward Resource Management cells to said Asynchronous Transfer Mode data cells, and for receiving  
15 returned resource management cells from downstream locations, for thereby spoofing downstream locations which expect to receive Resource Management cells during Asynchronous Transfer Mode data operation.

4. An arrangement according to claim 2, wherein said coaction of said spacecraft and terrestrial Network Control Center to determine the level of congestion in  
5 said at least one service other than said Asynchronous Transfer Mode data Available Bit Rate service produces a signal explicitly representative of payload congestion.

5. An arrangement according to claim 2, wherein said Resource Management cells of said Available Bit Rate service Asynchronous Transfer Mode data are transmitted from said

5 source terminal to a destination terminal by  
way of said spacecraft, and said destination  
terminal transmits said Available Bit Rate  
service Asynchronous Transfer Mode data which  
10 are received from said spacecraft to locations  
downstream of said destination terminal, and  
wherein back Resource Management cells arriving  
at said destination terminal are transmitted to  
said source terminal by way of said spacecraft,  
said arrangement further comprising;  
15 congestion information marking means  
located at said source terminal, for receiving  
said back Resource Management cells, and for  
controllably marking said back Resource  
Management cells with information derived from  
20 said payload congestion information, so that  
Resource Management cells returning toward said  
source of Available Bit Rate service  
Asynchronous Transfer Mode data include  
congestion data for controlling the cell rate  
25 of said Available Bit Rate service Asynchronous  
Transfer Mode data generated by said source of  
Available Bit Rate service Asynchronous  
Transfer Mode data for tending to control at  
least one of congestion at said spacecraft and  
30 at other locations of said transmission path.

6. A method for operating at least  
the spacecraft-related portion of a spacecraft  
data network for Available Bit Rate service  
Asynchronous Transfer Mode data, where routing  
5 switches of said spacecraft are not used for  
marking the data stream with congestion

information, said method comprising the steps of:

- at a source terminal, receiving said
- 10 Available Bit Rate service Asynchronous Transfer Mode data, and transmitting said Available Bit Rate service Asynchronous Transfer Mode data, together with its Resource Management cells, to a destination terminal by
- 15 way of said spacecraft, whereby said Resource Management cells of said Available Bit Rate service Asynchronous Transfer Mode data arriving at said destination terminal do not carry spacecraft congestion information
- 20 relating specifically to said Available Bit Rate service Asynchronous Transfer Mode data; determining spacecraft payload congestion attributable to a plurality of services, including services other than said
- 25 Available Bit Rate service Asynchronous Transfer Mode data, to thereby generate payload congestion signals;
- transmitting said payload congestion signals to said source terminal; and
- 30 at said source terminal, controllably marking said Resource Management cells of said Available Bit Rate service Asynchronous Transfer Mode data with information derived from said payload congestion signals.